10 Rec'd PCT/PTO 04 APR 2001

FORM PTO-1390(Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)
112740-184	09/786063

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/06286	26 August 1999	08 August 1998

TITLE OF INVENTION

TELECOMMUNICATION SYSTEM AND METHOD FOR TRANSMITTING DATA AND TELECOMMUNICATION SYSTEM SYNCHRONIZATION METHOD

APPLICANT(S) FOR DO/EO/US

Stefan Hennen et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Submission of Drawings - Figures 1-2 on two sheets

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
	PCT/EP99/06286	112740-184

21. The following fees are submitted:.	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00		
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO $860.00		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	$0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	27 - 20 =	7	x $18.00	$126.00	
Independent claims	3 - 3 =	0	x $80.00	$0.00	
Multiple Dependent Claims (check if applicable) .			☐	$0.00	
TOTAL OF ABOVE CALCULATIONS =				$986.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable) .			☐	$0.00	
SUBTOTAL =				$986.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				$0.00	
TOTAL NATIONAL FEE =				$986.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).			☐	$0.00	
TOTAL FEES ENCLOSED =				$986.00	
				Amount to be: refunded	$
				charged	$

☒ A check in the amount of **$986.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, IL 60690-1135

SIGNATURE

William E. Vaughan
NAME

39,056
REGISTRATION NUMBER

February 28, 2001
DATE

09/786063
JC02 Rec'd PCT/PTO 28 FEB 2001

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS:	Stefan Hennen et al.	DOCKET NO: 112740-184
SERIAL NO:		GROUP ART UNIT:
		EXAMINER:
INTERNATIONAL APPLICATION NO:		PCT/EP99/06286
INTERNATIONAL FILING DATE:		26 August 1999
INVENTION:	TELECOMMUNICATION SYSTEM AND METHOD FOR TRANSMITTING DATA AND TELECOMMUNICATION SYSTEM SYNCHRONIZATION METHOD	

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In The Specification:

On amended page 1, cancel lines 1-4 and substitute the following therefor:

--S P E C I F I C A T I O N

TITLE

TELECOMMUNICATION SYSTEM AND METHOD FOR TRANSMITTING DATA, AND TELECOMMUNICATION SYSTEM SYNCHRONIZATION METHOD

BACKGROUND OF THE INVENTION

Field of the Invention--.

On amended page 1, line 6, insert --present-- before "invention".

On amended page 1, lines 6-7, cancel "telecommunication system according to the preamble of claim 1, to a".

On amended page 1, line 8, insert a --,-- after "system".

On amended page 1, line 9, insert --telecommunication system and-- before "method".

On amended page 1, line 9, cancel "a" after "from".

On amended page 1, line 11, insert --present-- before "invention".

On amended page 1, before line 15, insert the following left-hand justified heading:

--**Description of the Prior Art**--.

On amended page 1, line 16, cancel "by means of" and substitute therefor --via which--.

On amended page 2, line 13, cancel "means" and substitute therefor --refers to--.

On amended page 2, line 18, cancel "means" and substitute therefor --refers to--.

On amended page 2, line 22, cancel "must".

On amended page 2, line 22, insert --must-- after "always".

On page 4, lines 4-5, cancel "i.e. in networks".

On page 4, line 6, insert a --,-- after "SONET".

On page 4, line 6, insert a --,-- after "bus".

On page 5, line 22, cancel "comprises" and substitute therefor --includes--.

On page 5, line 26, cancel "comprises" and substitute therefor --includes--.

On page 5, line 29, cancel "figure" and substitute therefor --Figure--.

On amended page 6, line 18, cancel "In consequence" and substitute therefor --As such--.

On amended page 6, line 31, cancel "can".

On amended page 6, line 31, insert --can-- after "also".

On amended page 6, line 33, insert --present-- before "invention".

On amended page 6, line 33, insert a --,-- after "is".

On amended page 6, line 33, insert a --,-- after "thus".

On amended page 6, lines 33-34, cancel "based on the object of specifying" and substitute therefor --directed to--.

On amended page 6, line 35, cancel "and" and substitute therefor a --,--.

On amended page 7, line 1, insert a --,-- after "system".

On amended page 7, line 1, insert --a method-- after "and".

On amended page 7, cancel lines 5-9 and substitute the following centered heading therefor:

--**SUMMARY OF THE INVENTION**--.

On amended page 7, line 10, cancel "The particular achievement of the" and substitute therefor --Accordingly, the present--.

On amended page 7, line 10, cancel "is" and substitute therefor --teaches--.

On amended page 7, line 20, insert --present-- before "invention".

On amended page 7, line 35, insert --present-- before "invention".

On amended page 8, line 1, cancel "are" and substitute therefor --is--.

On amended page 8, cancel lines 7-8 and substitute the following therefor:

--Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS--.

On amended page 8, line 11, insert --teachings of the present-- before "invention".

On amended page 8, line 11, cancel the "," and substitute therefor a --;--.

On amended page 8, before line 13, insert the following centered heading:

--**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**--.

On amended page 8, line 15, cancel "comprises" and substitute therefor --includes--.

On amended page 9, line 1, cancel "are" and substitute therefor --is-- page 2, line 33, cancel "are" and substitute therefor --is--.

On amended page 9,line 13, insert --present-- before "invention".

On amended page 9, line 18, insert --present-- before "invention".

On amended page 9, line 21, cancel "comprises" and substitute therefor --includes--.

--Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.—

On page 16 (last page), cancel lines 1-4 and substitute the following centered heading therefor:

--**ABSTRACT OF THE DISCLOSURE**

On page 16, line 9, insert a --,-- after "item".

On page 16, line 16, cancel "invention is intended to simplify" and substitute therefor –present telecommunication system simplifies--.

On page 16, line 18, cancel "4-10".

On page 16, line 18, cancel "22-28".

On page 16, line 21, cancel "2".

On page 16, line 21, cancel "30".

On page 16, line 22, insert --present-- before "method".

On page 16, lines 23-24, cancel "comprises a step of" and substitute therefor --includes--.

On page 16, line 25, insert --present-- before "method".

On page 16, line 26, cancel "comprises a step of" and substitute therefor --includes--.

On page 16, cancel line 30.

In the Claims:

On page 11, cancel line 1, and substitute the following left-hand justified heading therefor:

--**We Claim As Our Invention:**--.

Please cancel claims 1-27, without prejudice, and substitute the following claims therefor:

28. A telecommunication system for transmitting data via at least one of a plurality of different transmission networks, the telecommunication system being supplied with at least one clock signal as synchronization source from the at least one transmission network, the telecommunication system comprising:

at least one interface unit for receiving data from the at least one transmission network, the data describing a quality of the clock signal supplied via the at least one transmission network;

a device for assessing the quality of the at least one clock signal; and

a converter in the at least one interface unit which converts the data describing the quality of the clock signal into messages, the format of the messages being independent of a format of the data transmitted, and which transmits the messages to the device for assessment.

29. A telecommunication system as claimed in claim 28, wherein the converter receives additional messages from the device and converts the additional messages into data of a format of the at least one transmission network.

30. A telecommunication system as claimed in claim 28, wherein the data contains both user data and supplementary data, the quality of the clock signal being described by the supplementary data.

31. A telecommunication system as claimed in claim 28, wherein the plurality of different transmission networks includes at least one PDH transmission network.

32. A telecommunication system as claimed in claim 28, wherein the plurality of different transmission networks includes at least one LDH transmission network.

33. A telecommunication system as claimed in claim 28, wherein the plurality of different transmission networks includes at least one SONET transmission network.

34. A telecommunication system as claimed in claim 28, wherein the messages for describing the quality contain numerical values within a value range.

35. A telecommunication system as claimed in claim 34, wherein the value range is at least as wide as a largest value range of the data transmitted.

36. A telecommunication system as claimed in claim 34, wherein the value range includes four bits of a byte.

37. A method for operating a telecommunication system which is connected to at least one of a plurality of different transmission networks, the telecommunication system being supplied with at least one clock signal from the at least one transmission network as a synchronization source, the method comprising the steps of:

receiving data, from the at least one transmission network and in a format used in the at least one transmission network, which describes a quality of the clock signal supplied;

converting the data into messages of a format which is independent of the format of the received data;

assessing the quality of the clock signal by assessing the messages;

deciding whether the telecommunication system is to be synchronized with the clock signal; and

synchronizing the telecommunication system with the clock signal if it is decided that the telecommunication system is to be synchronized with the clock signal.

38. A method for operating a telecommunication system as claimed in claim 37, wherein the step of receiving data includes the steps of receiving user data and of receiving supplementary data, the data describing the quality of the clock signal being the supplementary data.

39. A method for operating a telecommunication system as claimed in claim 37, wherein the data is data of a PDH transmission network.

40. A method for operating a telecommunication system as claimed in claim 37, wherein the data is data of an SDH transmission network.

41. A method for operating a telecommunication system as claimed in claim 37, wherein the data is data of a SONET transmission network.

42. A method for operating a telecommunication system as claimed in claim 37, wherein the step of converting the data into messages includes recalculating a value of the quality of the clock signal into a value of an independent value range.

43. A method for operating a telecommunication system as claimed in claim 42, wherein the step of recalculating is reversible without loss.

44. A method for operating a telecommunication system as claimed in claim 42, wherein the step of recalculating includes setting four bits of one byte.

45. A method for operating a telecommunication system as claimed in claim 37, wherein the step of deciding includes selecting a highest-quality clock signal supply.

46. A method for operating a telecommunication system as claimed in claim 37, wherein the step of deciding includes selecting a clock signal having a quality which is above a threshold value.

47. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks, the data describing a quality of a clock signal with which the telecommunication system is synchronized, the method comprising the steps of:

generating a message describing the quality in a format which is independent of formats of the data to be transmitted;

converting the messages into data of a format used in the at least one transmission network; and

transmitting the data into the at least one transmission network.

48. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 47, wherein the data includes both user data and supplementary data, the data describing the quality of the clock signal being the supplementary data.

49. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 47, wherein the data is data of a PDH transmission network.

50. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 47, wherein the data is data of an SDN transmission network.

51. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 47, wherein the data is data of a SONET transmission network.

52. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 47, wherein the step of converting the messages into data includes recalculating the value of the quality of the clock signal into a value of an independent range.

53. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 52, wherein the step of recalculating is reversible without loss.

54. A method for transmitting data from a telecommunication system into at least one of a plurality of different transmission networks as claimed in claim 52, wherein the step of recalculating includes setting four bits of one byte.

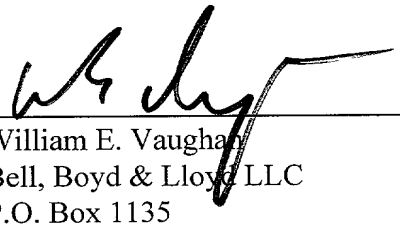
REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claims 1-27 have been canceled in favor of new claims 28-54. Claims 28-54 have been presented solely because the revisions by bracketing and underlining which

would have been necessary in claims 1-27 in order to present those claims in accordance with preferred United States Patent practice would have been too extensive, and thus would have been too burdensome. The amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-27 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-27.

Early consideration on the merits is respectfully requested.

Respectfully submitted,



(Reg. No. 39,056)

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135
(312) 807-4292
Attorneys for Applicants

Description

Telecommunication system and methods for synchronizing the system and for transmitting data

The invention relates to a telecommunication system according to the preamble of claim 1, to a method for synchronizing a telecommunication system and to a method for transmitting data from a telecommunication system into at least one transmission network. In particular, the invention relates to telecommunications systems which are used for transmitting data via a multiplicity of various transmission networks.

The term "telecommunication" is a generic term for all communication transmission methods by means of various services in long-distance man-man, man-machine and machine-machine communication. Telecommunication is attaining a very special significance due to the growing-together of information technology and communication technology. Telecommunication is characterized by the transmission technology involving cable transmission technology, radio voice and data transmission, satellite technology, optical fiber technology, modems, digital switching systems and switching technology and local area networks.

To provide for a meaningful exchange of messages between two (or more) parties requires, in addition to the pure transmission of messages, a rule system which defines the conventions to be adhered to for meaningful communication in the form of protocols. Such rules are described, for example, in the service specifications of the individual layers of the OSI (open systems interconnection) Reference Model. The OSI Reference Model was created by the International Standardization Organization (ISO) in 1983 on the basis of the transmission of information in the field of data processing and is now also very widely

used in applications of the communication systems. The OSI Model only represents principles of information transmission and, in consequence, only defines the logic of the information flow between subscribers. Since the OSI standard does not contain any specifications on the physical transmission of communication, it is manufacturer-independent but needs supplementary protocols for more detailed specification on the basis of other, e.g. proprietary standards, to implement a communication system.

In principle, a distinction can be made between asynchronous and synchronous communication. Asynchronous communication generally means the exchange of messages between a transmitting and a receiving entity which is completely decoupled in time. The time when a transmitting and its associated receiving operation is initiated cannot be predicted.

By comparison, synchronous communication means the exchange of messages between a transmitting and a receiving entity if this exchange occurs within a fixed timing pattern. In this context, a transmitting and its associated receiving operation must always be executed at the same time.

Telecommunication networks are characterized by the possibility of bidirectional and multidirectional data exchange between the subscribers. This presupposes that each subscriber involved can communicate with any other subscriber via the same medium. The simplest implementation of this is the communication of all subscribers in baseband. Due to the multiplicity of parallel active subscribers, methods are predominantly used which statically allocate the available bandwidth to the subscribers in time-division multiplex. Due to the increasing utilization of optical fiber technology, the necessity of improved intercontinental data communication and the increased performance requirements, the plesiochronous digital hierarchy (PDH), which has been prevailing since the 60s, is

increasingly replaced by the synchronous digital hierarchy (SDH).

In the plesiochronous digital hierarchy, the data of various terminal systems present in PCM (pulse code modulation) are multiplexed bit by bit into a data stream. A hierarchical level is characterized by the number of basic channels multiplexed by it or, respectively, of the frames of the next lower hierarchical level.

Due to the difference in transmission rate of a basic channel in Europe and in the US, incompatible PDH hierarchies were formed. The DS1 standard prevailing in the US provides for three hierarchical levels whereas five levels are provided in the European E1 standard. The lowest level (E1) multiplexes 30 basic channels. Due to the plesiochronous transmission in which deviations of $(2 - 5)10^{-2}$ Hz from the nominal clock rate are permissible, the nominal transmission rates do not exactly correspond to a multiple of the next lower level but are slightly higher. The gap within a hierarchical level which thus occurs due to the permissible fluctuations is solved by stopping bits which do not contain any information (positive stopping).

Although optical fibers are also used as transmission medium for the higher PDH levels, the increase use of optical fibers led to considerations with regard to a new more powerful approach which was intended to replace the obsolete PDH technology even back in the 80s.

The development in the US was initiated by the Bellcore company and taken over by the Industrial Carriers Compatibility Forum (ICCF) in 1984. The American SONET (Synchronous Optical Network) standard emerging from this resulted in the international or SDH (Synchronous Digital Hierarchy)

standard issued by the International Telecommunications Union (ITU).

SONET is the standard issued by the CCITT for a family of interfaces for use in optical networks, i.e. in networks, the transmission medium of which is an optical fiber. SONET thus for the first time enables terminals from various manufacturers to be connected in standardized form and optical multiplexes with digital cross connects to be directly connected. In these arrangements, data rates of 51.84 Mb/s to over 2.4 Gb/s are achieved.

The synchronous digital hierarchy (SDH) is occasionally also called the international variant of SONET. The basic format of the SDH transmission is the STM-1 (synchronous transport module) frame. The STM-1 frame is composed of a header, with supplementary section information and a user data section, the container. Common to the STM frames also of all higher hierarchical levels is a fixed transmission time. Since the SDH standard is compatible with the SONET standard above a transmission rate of 155 Mb/s, SDH provides for simpler intercontinental data communication compared with PDH. Due to the lower overhead in comparison with the payload, SDH is also distinguished by very good efficiency of over 96%.

As a rule, telecommunication systems which are connected to standardized transmission networks such as PDH, SDH or SONET require synchronization in order to achieve the necessary clock accuracy at the interface to the transmission network. In this context, a distinction is made between two modes of synchronization. In the case of external synchronization, the system is supplied directly with a clock from an external synchronization source. In synchronization via the transmission link, by comparison, the clock is obtained from the received data stream of the interface and supplied as synchronization source to the system. For this purpose, the received

data frames also contain, among other things, supplementary information describing the quality of the clock signal of a distant station in addition to the user information.

In some of the interface types in plesiochronous digital hierarchy, the clock signal quality is transmitted in the timing marker bit. Table 1 shows the timing marker bit MA byte according to PDH (ITU G.832, E3).

In the case of SONET and the synchronous digital hierarchy SDH, the quality of the clock signal is communicated in the so-called SSM (synchronization status message) byte. Table 2 shows the SSM definition in SONET (Bellcore GR253) and Table 3 shows the SSM definition in the synchronous digital hierarchy (ITU G.708).

Since different standardized transmission networks such as PDH, SDH or SONET exist in parallel, there is a need for telecommunication systems which maintain connections to a number of these transmission networks at the same time. Figure 2 shows such a telecommunication system which comprises a main processor MP 2 and interface cards 4-10. Such a telecommunication system has a separate interface card for each different interface type. The telecommunication system also comprises a synchronization system 12 which is connected both to the main processor 2 and the interface cards.

As shown in figure 2 under reference symbol 14, the interface cards 4-10 communicate the respective clock signal qualities to the main processor 2. In addition, the interface cards, as shown under reference symbol 16, supply the clock obtained from the transmission network in each case to the synchronization system 12. The synchronization system synchronizes the telecommunication system with a clock 16 transmitted from the interface cards under control by the main processor 2 via connections 17.

On the basis of the clock signal qualities received from the interface cards 4-10 via the connections 14, the main processor 2 assesses with which one of the clock signals supplied from the standardized transmission networks the telecommunication system is to be synchronized. Since, as stated above and as can be seen from tables 1 to 3, the clock signal quality information items provided by the different interface types are present in different formats and even have different value ranges, the clock signal qualities from different interface types must be treated separately in the main processor 2. For this purpose, the main processor has subunits 20, each one of which is provided for processing the clock signal quality information items of one interface type (PDH, SDH, SONET). These different subunits 20 of the main processor 2 in each case have a different structure and in each case have different functionalities due to the different data formats. In consequence, the clock signal qualities are treated separately in the main processor. Different treatment is also evident from the current draft of ITU-T, G.synce, 01/98 (synchronization layer functions). This draft distinguishes between options 1 to 3, options 1 and 3 describing the synchronous digital hierarchy according to the previous ITU standard whereas option 2 relates to the SONET based on Bellcore.

Telecommunication systems of the aforementioned design have a disadvantage that a number of algorithms for the value ranges and formats inherent in the different transmission networks are necessary in the main processor. Owing to the different standards in existence, which can also differ in various countries, an adaptation of the main processor is therefore always necessary.

The invention is thus based on the object of specifying a telecommunication system of the abovementioned type and a method

for synchronizing such a telecommunication system and for transmitting data from such a telecommunication system, in which the communication of clock signal qualities is simplified.

This object is achieved by the subject matters of claims 1, 10 and 20.

Advantageous embodiments of the invention are the subject matters of claims 2 to 9, 11 to 19 and 21 to 27.

The particular achievement of the invention is that the clock signal quality is processed in accordance with only one algorithm in the system. Differentiation between the interface type is no longer required.

Avoiding separate treatments of clock signal qualities from different transmission networks results in a simplification of the internal communication in the system, especially during transmission, since the main processor 2 of a telecommunication system according to the invention only generates one value of the clock signal quality and forwards it to all interface cards connected. This dispenses with the generation of different data formats in the main processor. This is associated with a reduction in the hardware and software expenditure in the main processor.

Furthermore, the number of messages to be sent is advantageously reduced and the performance of the system is enhanced.

A further advantage results from the simplified upgradability of the telecommunication system when a new transmission network standard is introduced since the main processor does not contain any standard-dependent elements.

Furthermore, the invention advantageously creates a telecommunication system which, when data

are converted into a format which is independent of the formats of the transmission networks, selects a value range of the independent format which covers all specific formats. This prevents a loss of information with respect to the clock signal quality of individual transmission networks.

In the text which follows, preferred exemplary embodiments of the invention are explained.

Fig. 1 shows a preferred exemplary embodiment of a telecommunication system according to the invention, and

Fig. 2 shows a conventional telecommunication system.

Figure 1 shows a preferred exemplary embodiment of a telecommunication system which, like the known telecommunication system described above, comprises a main processor 2, a number of interface cards 4-10 and a synchronization system 12. In addition, the interface cards 4-10 have converters 22-28 which convert the interface-specific clock signal qualities into a uniform format. For example, the timing marker converter 22 converts the information on the clock signal quality of the PDH transmission network, contained in the timing marker bit, into the uniform format. The SSM converters 24, 26 of the SDH interface card 6 and the SONET interface card 8 convert the quality information items shown in tables 2 and 3, contained in the SSM data, into the uniform format. These uniformly formatted clock signal qualities are transmitted to the main processor 2 as shown at reference symbol 32. The main processor 2 has a common subunit 30 which receives the uniformly formatted clock signal qualities of all interface cards, processes them by using a single common algorithm and forwards them to the main processor for processing.

When data are transmitted from the telecommunication system to one or more transmission networks, the common subunit 30 of the main processor 2 transmits the current clock signal quality in the uniform data format via the connections 32 to the converters 22-28 of the interface cards 4-10. The converters convert the received clock signal quality into the corresponding data format of the respective transmission network, shown in tables 1 to 3, so that the data to be transmitted can be transmitted to the distant station by the respective interface card 4-10.

According to a preferred embodiment of the invention, the uniform format of the clock signal qualities has a value range which exhibits at least the extent of the largest value range of the transmission networks connected. The clock signal quality is preferably stored in four bits of a byte.

09/30/98, EAST Version: 1.03.0002

Table 1

Description	Timing marker bit (MA byte)
Primary reference clock	0
Unknown	1

Table 2

Description	SSM-Z1-byte Bits 8-5	DS1-ESF data connection code word
Primary reference clock	1000	00000100 11111111
Normal, unknown quality	0000	00001000 11111111
Layer 2 hold over	1110	00001100 11111111
Layer 3 hold over	0101	00010000 11111111
SONET self-timed	0011	00100010 11111111
Layer 4 free running	N/A	00101000 11111111
Unsuitable for synchronization	1111	00110000 11111111

Table 3

Description	SSM-S1 byte, bits 5-8
G.811	0010
Synchronization network exists, quality unknown	0000
G.812 Transit node	0100
G.812 Local node	1000
SDH SETS	1011
Unsuitable for synchronization	1111

Patent claims

1. Telecommunication system for transmitting data via at least one of a multiplicity of different transmission networks, the telecommunication system being supplied with at least one clock as synchronization source from the at least one transmission network, consisting of:
at least one interface unit (4-10) for receiving data from the at least one transmission network, which describe the quality of the clock signal supplied via the at least one transmission network, and
a device (2, 30) for assessing the quality of the at least one clock signal supplied,
characterized in that the at least one interface unit (4-10) comprises a converter (22, 28) which converts the data describing the quality into messages the format of which is independent of those of the data transmitted, and transmits these messages to the device (2, 30) for assessment.

2. The telecommunication system as claimed in claim 1, characterized in that the converter (22, 28) is set up in such a manner that it receives messages from the device (2, 30) for assessment and converts them into data of the format of the at least one transmission network.

3. The telecommunication system as claimed in claim 1 or 2, characterized in that the data contain user data and supplementary data, the quality of the clock signal being described by the supplementary data.

4. The telecommunication system as claimed in one of claims 1 to 3, characterized in that the multiplicity of different transmission networks comprises at least one PDH transmission network.

5. The telecommunication system as claimed in one of claims 1 to 4, characterized in that the multiplicity of different transmission networks comprises at least one SDH transmission network.

6. The telecommunication system as claimed in one of claims 1 to 5, characterized in that the multiplicity of different transmission networks comprises at least one SONET transmission network.

7. The telecommunication system as claimed in one of claims 1 to 6, characterized in that the messages for describing the quality contain numerical values within a value range.

8. The telecommunication system as claimed in claim 7, characterized in that the value range has at least the extent of the largest value range of the data transmitted.

9. The telecommunication system as claimed in claim 7, characterized in that the value range comprises four bits of a byte.

10. A method for synchronizing a telecommunication system which is connected to at least one of a multiplicity of different transmission networks, the telecommunication system being supplied with at least one clock signal from the at least one transmission network as synchronization source, the method having the following steps:

receiving data which describe the quality of the clock signal supplied, from the at least one transmission network in a format used in the at least one transmission network,

converting the data into messages of a format which is independent of the format of the received data,

assessing the quality of the clock signals supplied by assessing the messages,

deciding whether the telecommunication system is to be synchronized with the clock signal supplied, and

synchronizing the telecommunication system with the clock signal supplied if the telecommunication system is to be synchronized with the clock signal supplied.

11. The method as claimed in claim 11, the step of receiving data comprising the steps of receiving user data and of receiving supplementary data, the data describing the quality of the clock signal being supplementary data.

12. The method as claimed in claim 10 or 11, the data being data of a PDH transmission network.

13. The method as claimed in one of claims 10 to 12, the data being data of a SDH transmission network.

14. The method as claimed in one of claims 10 to 13, the data being data of a SONET transmission network.

15. The method as claimed in one of claims 10 to 14, the step of converting the data into messages comprising a step of recalculating the value of the quality of the clock signal supplied into a value of an independent value range.

16. The method as claimed in claim 15, the step of recalculation being reversible without loss.

17. The method as claimed in claim 15, the step of recalculating comprising the setting of four bits of one byte.

18. The method as claimed in one of claims 10 to 17, the step of deciding comprising the selection of the highest-quality clock signal supplied.

19. The method as claimed in one of claims 10 to 17, the step of deciding comprising the selection of a clock signal supplied, the quality of which is above a threshold value.

20. A method for transmitting data from a telecommunication system into at least one of a multiplicity of different transmission networks, the data describing the quality of a clock signal with which the telecommunication system is synchronized, the method exhibiting the following steps:

generating a message describing the quality, in a format which is independent of formats of the data to be transmitted,

converting the messages into data of a format used in the at least one transmission network, and transmitting the date into the at least one transmission network.

21. The method as claimed in claim 20, the step of receiving data comprising the steps of receiving user data and of receiving supplementary data, the data describing the quality of the clock signal being supplementary data.

22. The method as claimed in claim 20 to 21, the data being data of a PDH transmission network.

23. The method as claimed in claim 20 to 22, the data being data of a SDH transmission network.

24. The method as claimed in claim 20 to 23, the data being data of a SONET transmission network.

25. The method as claimed in one of claims 20 to 24, the step of converting the data into messages comprising a step of recalculating the value of the quality of the clock signal supplied into a value of an independent range.

09/06/98 - 09:44

26. The method as claimed in claim 25, the step of recalculating being reversible without loss.

27. The method as claimed in claim 25 or 26, the step of calculating comprising the setting of four bits of one byte.

Abstract

Telecommunication system and method for synchronizing the system and for transmitting data

Telecommunications systems can be synchronized via the transmission link. In this process, the telecommunication systems receive the clock signal and an additional information item which describes the quality of the clock signal, from the received data stream. In telecommunication systems which are connected to a number of differently standardized transmission networks, different algorithms for evaluating the differently formatted clock signal quality data are necessary in the main processor. The invention is intended to simplify the communication of clock signal qualities. The different interface cards 4-10 have converters 22-28 which convert the clock signal quality information between a transmission-network-specific format and an independent format. The main processor 2 only contains a subunit 30 for processing all clock signal qualities. The method for synchronizing a telecommunication system comprises a step of converting the transmission-network-specific data into messages of an independent format. The method for transmitting data comprises a step of converting the independently formatted messages into transmission-network-specific data.

Figure 1

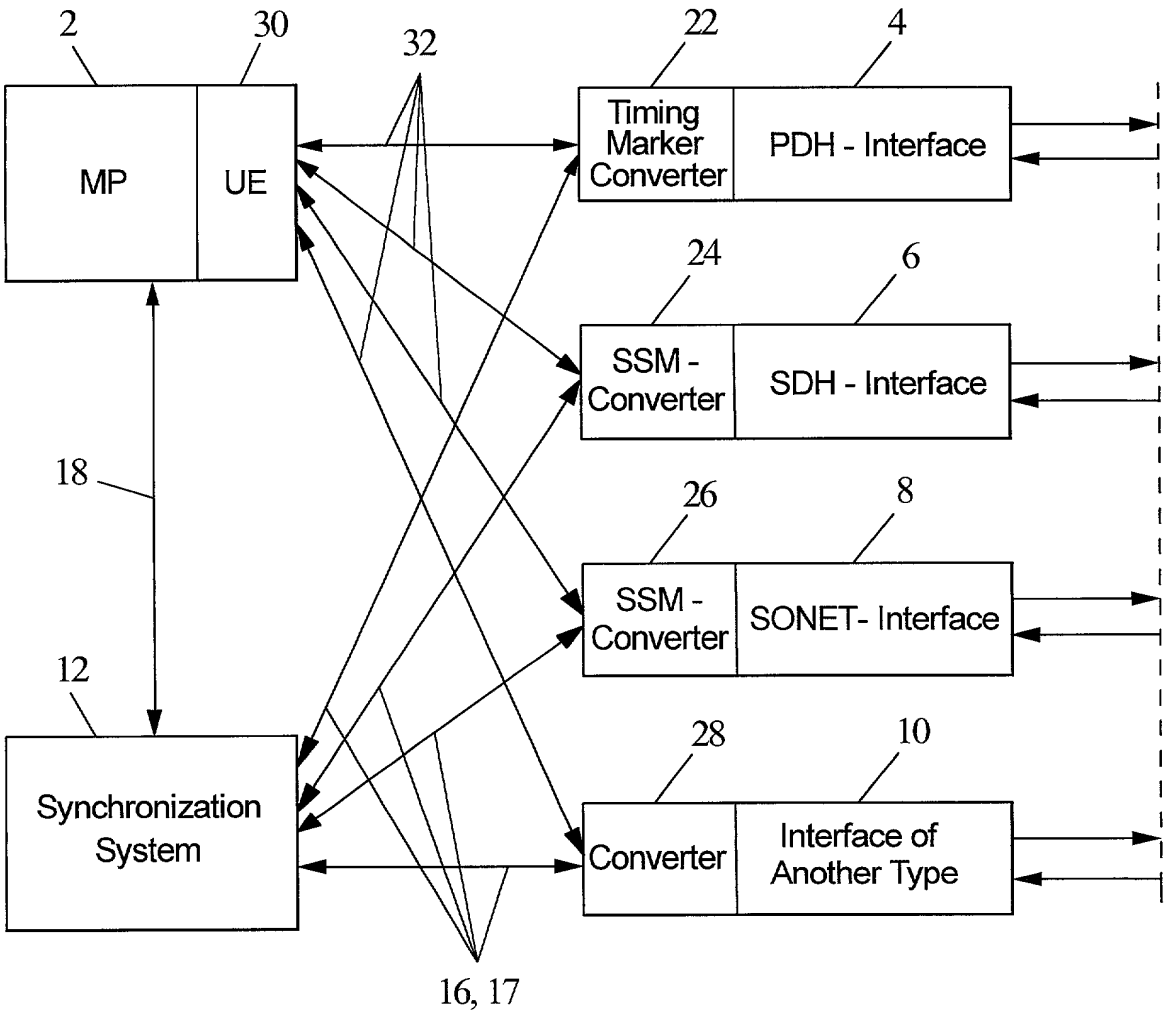

2
30
32
22
4
MP
UE
Timing Marker Converter
PDH - Interface
24
6
SSM - Converter
SDH - Interface
18
26
8
SSM - Converter
SONET- Interface
12
28
10
Synchronization System
Converter
Interface of Another Type
16, 17

FIG. 1

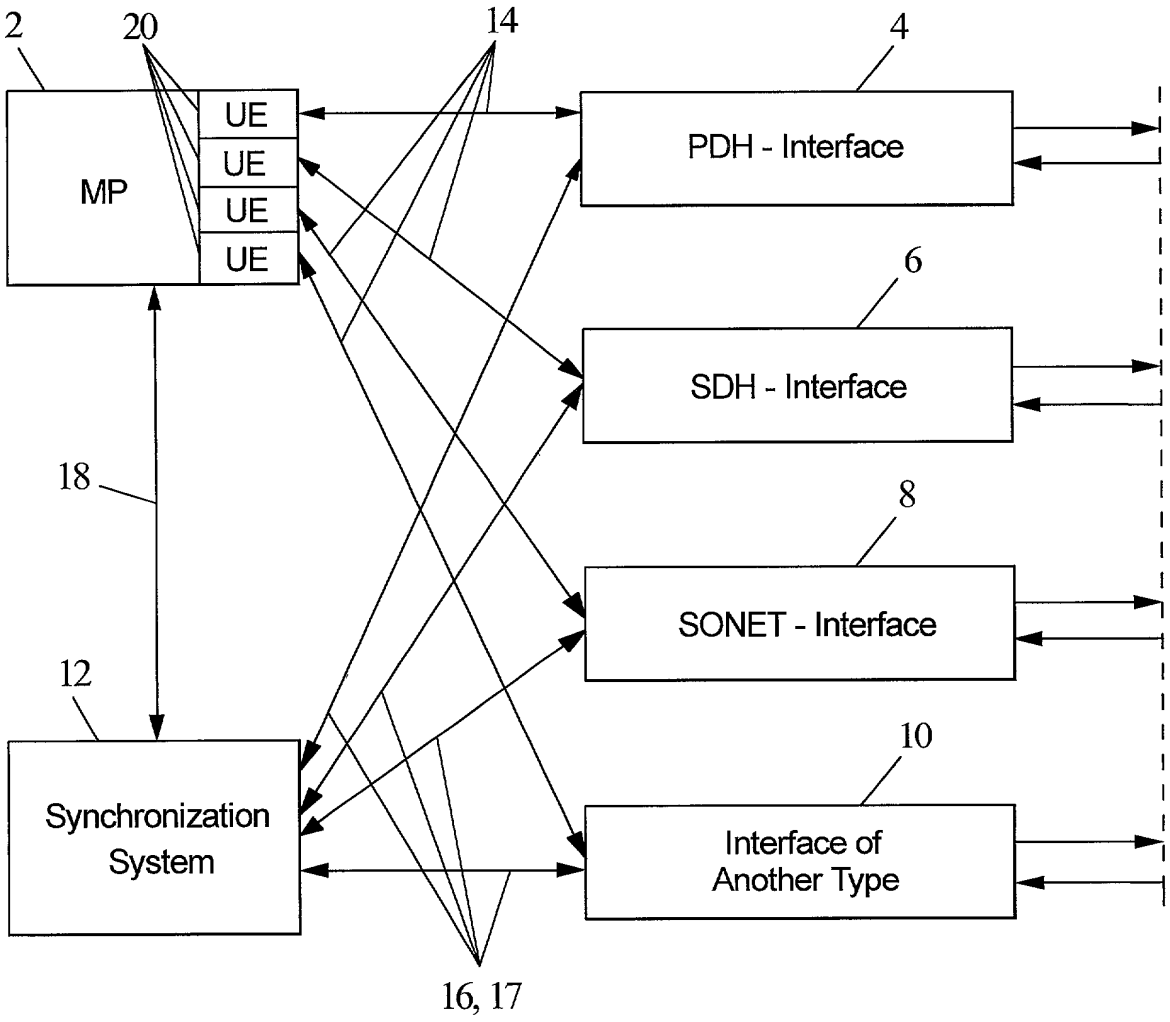

2
20
14
4
UE
UE
UE
UE
MP
PDH - Interface
6
SDH - Interface
18
8
SONET - Interface
12
10
Synchronization System
Interface of Another Type
16, 17

FIG. 2

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Telekommunikationssystem sowie Verfahren zum Synchronisieren desselben und zum Senden von Daten

deren Beschreibung

(zutreffendes ankreuzen)

☐ hier beigefügt ist.

☒ am 26. August 1999 als PCT internationale Anmeldung PCT Anmeldungsnummer PCT/EP99/06286 eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

(check one)

☐ is attached hereto.

☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
981 16 319.9	Germany	28. August 1998	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhangig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. William E. Vaughan (Reg. No. 39,056); Robert M. Barrett (Reg. No. 30,142); Michael S. Leonard (Reg. No. 37,557); Patricia A. Kane (Reg. No. 46,446); Thomas C. Basso (Reg. No. P46,541); Robert W. Connors (Reg. No. P46,442); Troy A. Groetren (Reg. No. 46,442); Adam H. Masia (Reg. No. 35,602); Dante J. Picciano (Reg. No. 33,543); Amy J. Gast (Reg. No. 41,773); Timothy L. Harney (Reg. No. 38,174); Renato L. Smith (Reg. No. 45,117); and Alan L. Barry (Reg. No. 30,819)

13

Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

(312) 807-4292
Ext. _____

Postanschrift:

Send Correspondence to:

William E. Vaughan
Bell, Boyd & Lloyd
P.O. Box 1135
Chicago, IL 60690-1135

Voller Name des einzigen oder ursprünglichen Erfinders: HENNEN, Stefan	Full name of sole or first inventor:
Unterschrift des Erfinders / Datum Stefan Hennen 19.02.01	Inventor's signature / Date
Wohnsitz D-82131 Gauting, Germany DEX	Residence
Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Reismühlerstr. 51 D-82131 Gauting Bundesrepublik Deutschland	Post Office Addess
Voller Name des zweiten Miterfinders (falls zutreffend): RODER, Annette	Full name of second joint inventor, if any: ,
Unterschrift des Erfinders / Datum A Roder 12.03.01	Second Inventor's signature / Date
Wohnsitz D-81377 München, Germany DEX	Residence
Staatsangehorigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Esterbergstr. 3 D-81377 München Bundesrepublik Deutschland	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

Voller Name des dritten Miterfinders: SKORKA, Klemens	Full name of third joint inventor:
Unterschrift des Erfinders Datum 20.02.01	Inventor's signature Date
Wohnsitz D-80807 München, Germany DEX	Residence
Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Dewetstr. 17 D-80807 München Bundesrepublik Deutschland	Post Office Address
Voller Name des vierten Miterfinders (falls zutreffend): STEINIGKE, Klaus	Full name of fourth joint inventor, if any:
Unterschrift des Erfinders Datum 20.2.01	Inventor's signature Date
Wohnsitz D-81369 München, Germany DEX	Residence
Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Johann-Clenze-Str. 39 D-81369 München Bundesrepublik Deutschland	Post Office Address
Voller Name des fünften Miterfinders (falls zutreffend):	Full name of fifth joint inventor, if any:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Voller Name des sechsten Miterfinders (falls zutreffend):	Full name of sixth joint inventor, if any:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehorigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).